VOLUME 51
Spring 2014
http://gps.faa.gov

SatNavNews

FAA Navigation Services, AJM-321

The *SatNav News* is produced by the Navigation Programs AJM-32 branch of the Federal Aviation Administration (FAA). This newsletter provides information on the Global Positioning System (GPS), the Wide Area Augmentation System (WAAS) and the Ground Based Augmentation System (GBAS).

Inside ...

WAAS Benefits Driving Equipage

The Wide Area Augmentation System (WAAS), also known as a Satellite Based Augmentation System (SBAS), is used by a range of aircraft in all phases of flight. General aviation, business aviation, helicopter operators, and a number of regional airlines are experiencing increased access, more direct routes, and enhanced safety from this extremely accurate navigation system. Major airlines are also starting to show an increased interest in WAAS.

WAAS-enabled Localizer Performance with Vertical guidance (LPV) and Localizer Performance (LP) capabilities provide the most well-known benefits. For example, those equipped with WAAS can:

- Fly the WAAS-enabled LPV approach minima to Instrument Landing System (ILS)-like minima at runways that do not have an ILS
- Use WAAS LPV as a backup at ILS runways when the ILS is out of service
- Fly the WAAS-enabled LP approach minima where terrain or obstructions do not allow publication of vertically-guided LPVs
- Take advantage of minimums lower than those of Lateral Navigation (LNAV) that LP often provides
- Reduce operational costs through the additional, closer alternate airports that are available through the use of WAAS (resulting in lower fuel load requirements, better dispatch reliability, reduced delays, and reduced emissions).

WAAS enables additional capabilities that support and help to accelerate the realization of NextGen benefits. WAAS can:

- Provide a positioning source that can be used to meet the 2020 Automatic Dependent Surveillance-Broadcast (ADS-B) Out mandate. (Requirements are specified in Advisory Circular (AC) 20-165A)
- Support Radius to Fix (RF) arrivals and departures and Required Navigation Performance (RNP) 4 en-route.
- Enable RNP Authorization Required (AR) procedures and Area Navigation (RNAV) procedures with RF Legs
- Enable future Closely Spaced Parallel Operations (CSPOs)
- Provide potential to reduce separation standards, allowing increased capacity in a given airspace without increased risk
- Enable Q routes and T routes, providing direct routing and more efficient use of airspace
- Create opportunity for developing unrestricted Optimized Profile Descent (OPDs), helping to reduce delays
- Enable the reduction and simplification of avionics
- Provide potential to meet Enhanced Traffic Situational Awareness on the Airport Surface with Indications and Alerts (ATSA SURF IA) requirements. GPS alone may not.

Tell Us Your WAAS Story

We're collecting testimonials about the benefits of Wide Area Augmentation System (WAAS) navigation from users. If you are a pilot, passenger, airport manager, airline employee, or are involved in aviation in any capacity - whether you fly fixed-wing or vertical flight aircraft - we want to hear from you! Please send your stories and contact information to Mary Ann Davis at maryann.ctr.davis@faa.gov

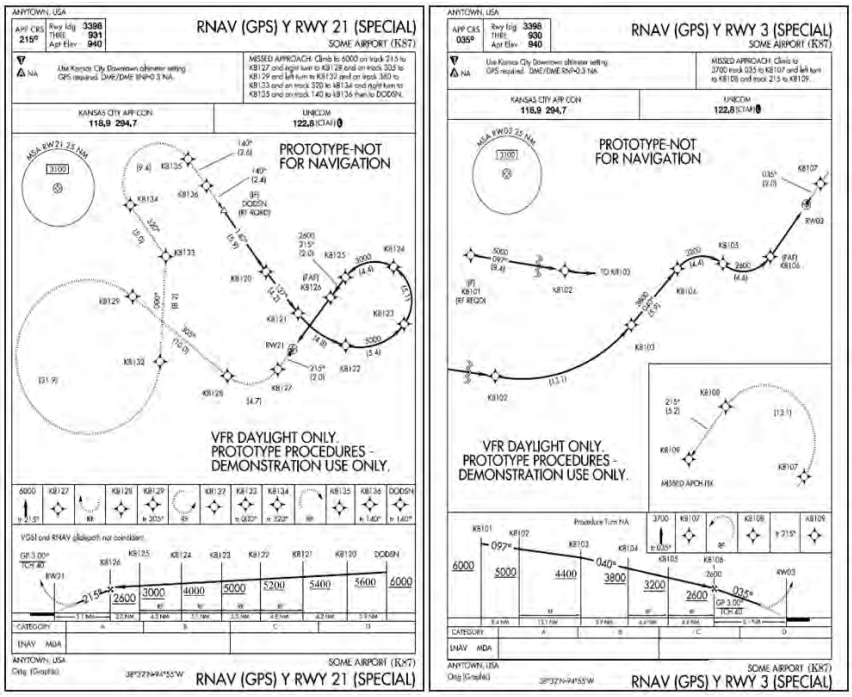
- Eliminate the need for Receiver Autonomous Integrity Monitoring (RAIM) checks, otherwise required when using GPS alone.

A change in avionics can be time-consuming and expensive; but, the return on investment realized by those who have taken this step has been positive. For example, Northern Air Cargo, Horizon Air, and Cape Air have all attested to the benefits received. (See The WAAS Experience video.) Benefits gained include an improved ability to maintain schedules from increased access; the opportunity to reduce carbon emissions from more efficient routes; and the ability to reduce passenger costs (also known as Passenger Value of Time, or PVT). As a result of these successful WAAS business cases, other airlines are looking more closely at the advantages of WAAS.

Over 70,000 aircraft are estimated to be equipped with WAAS in the U.S. today. WAAS comes standard on many new aircraft and, for those requiring an upgrade, supplemental type certificates (STCs) for WAAS have been completed for a broad range of aircraft. Airframes which have received WAAS STCs include Agusta (AW109SP), Boeing (737-200, 737-300), Bombardier (CRJ-900, Q-400), Cessna (402, 501, 550, C-208), Challenger, Dassault, Eurocopter, Gulfstream, Lear, and Sikorsky -- to name only a few. Avionics manufacturers who have completed or are working WAAS STCs include Avidyne, Genesys Aerosystems (Chelton), Garmin, Honeywell, Innovative Solutions & Support (IS&S), and Universal Avionics – again, only a few examples. Your avionics professional can help you better understand the process of adding WAAS to your particular aircraft, if it is not already equipped.

As the transition to satellite based navigation and NextGen moves forward, those who are WAAS-equipped will realize a wide array of benefits. Using WAAS is a proven way to improve efficiency and safety and to participate in the transition to NextGen; and, if you are in the air transport business; WAAS is a great way to gain competitive advantage.

- Dave Kerr, Mary Ann Davis and Cornell Walker (FAA AJM-321/NAVTAC)



The figures above are the example procedure profiles found in Appendix 7 of AC 20-138D.

RF Turns with WAAS

On March 28, 2014, the latest version of the advisory circular (AC) 20 -138, Airworthiness Approval of Positioning and Navigation Systems was released. AC 20 -138D includes a new appendix (Appendix 7) for demonstrating radius to fix (RF) leg capability.

RF legs can be flown using any navigation solution that meets the Required Navigation Performance (RNP) level. The use of the Global Positioning System (GPS) as a navigation solution can be sufficient; but, WAAS provides a more robust navigation solution than GPS alone. As a result, WAAS is a very effective enabler of RF turn capability.

In addition to this new appendix, AC 20-138D also adds clarifications and new guidance material to what was published in revision C .

The document is available on the FAA website at the following link - http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/0/87BEE4061F1C8D4086257CAF006B0C2C?OpenDocument. (click here)

- Dave Kerr and Mary Ann Davis (FAA AJM-321/NAVTAC)

Angel Flight Pilot: WAAS Reduces Our Workload!

An interview with Steve Craven, Angel Flight-Mid Atlantic Chairman, Director of Safety, Volunteer Pilot was conducted by Jennifer Campbell and Dave Kerr (FAA AJM-32/NAVTAC).

JC: Mr. Craven, thank you for agreeing to speak with us today about your experiences as a pilot, using WAAS. Could you please tell us how you came to be a WAAS pilot?

SC: As a volunteer pilot for Angel Flight Mid-Atlantic (AFMA), I have made many flights to and from Twin County Airport (HLX) located in

Steve Craven, Angel Flight Volunteer Pilot

Steve Craven and Richard Norris, a transport patient, after many successful WAAS-guided trips

southwest Virginia between Galax and Hillsville. At 2700 feet elevation and surrounded by ridges on all sides, HLX is an unfriendly environment even in VFR conditions. A minimum vectoring altitude (MVA) of 6000 also adds to the difficulty of safe access. WAAS changed everything. The facility can now be safely accessed in most weather conditions with LPV, LP and LNAV approaches.

JC: What was your usual navigation method before using WAAS?

SC: I began using VOR/Localizer/ILS flying a Cessna 172 with Loran. I used a GPS handheld receiver, for situational awareness. Then I stepped up to an Avidyne Entegra, and then to Garmin 430 GPS receivers, but they weren't yet WAAS capable. I upgraded, but only had a localizer. I really wanted glideslope capability, so in 2007 I upgraded to WAAS LPV.

JC: Tell us about Angel Flight?

SC: Angel Flight was created by a group of pilots who believe in the benefit of volunteering. Angel Flight Mid-Atlantic is a nonprofit 501(c)(3) organization using over 700 volunteer pilots to transport patients to specialized medical care. We are a coordinating service matching volunteer pilots willing to donate their time and aircraft to the individuals in need. AFMA completes an average of 125 missions per month. Our pilots are dedicated volunteers who donate their time, skills, plane and fuel to provide free medical air transportation for those in need.

JC: When did you begin flying with Angel Flight?

SC: I began as a volunteer with Angel Flight in 1997.

JC: When did WAAS make a big difference to you?

SC: I began using WAAS LPVs starting in 2007. I really found the benefits of WAAS when Angel flight was involved in taking face transplant patient, Richard Norris, from the Twin County area to Baltimore Washington Airport (BWI) so he could have medical procedures at University of Maryland Shock Trauma Center. 40 pilots transported Richard ~ 130 times from the Galax area to Baltimore. WAAS increases our safety tremendously.

Often, the way back from Baltimore was in the late evening, and when an approach is required, at night, we use the WAAS LPV to bring Richard home safely. We flew RNAV (GPS) with LPV minimums, basically, I just pressed a button and flew it in! WAAS made a big difference to us transporting Richard.

JC: Which other airports do you fly WAAS approaches for Angel Flight?

SC: I also transport a patient from Luray, Virginia to Boston Logan. Luray is in a valley with the nearby Blue Ridge rising to 4010 ft., meaning that a moderate cloud cover can quickly bring instrument meteorological conditions (IMC) to operations out of Luray. WAAS helps me navigate this safely. WAAS LPV is much more stable, and gives me more confidence when the ceiling is low. WAAS lightens the workload and increases the margin of safety.

JC: What are your plans to help spread the word about how you have benefited from WAAS?

SC: I plan to continue telling my fellow pilots about how WAAS decreases my workload. I plan to present WAAS at upcoming meetings of the "Friends of the Leesburg Airport" and the Dover Wings, Fraternity of Pilots.

JC and DK: Thank you for sharing your story. We know many pilots will appreciate reading about how WAAS has made such a dramatic impact in your service.

GAGAN Certified for Operational Use

The GPS-Aided Geo Augmented Navigation (GAGAN) system was recently certified for operational use. GAGAN, which like the Wide Area Augmentation System (WAAS) is a Satellite Based Augmentation System (SBAS), was jointly developed by the Indian Space Research Organization (ISRO) and Airports Authority of India (AAI). In December 2013, the system was provisionally certified for RNP 0.1 (Required Navigation Performance) service.

The ISRO press release can be found at http://www.isro.org/pressrelease/scripts/pressreleasein.aspx?Jan03_2014

On February 14, 2014, GAGAN became operational to support RNP 0.1 in the en route phase of flight over the entire Indian Flight Information Region.

More on GAGAN and the interoperability of all worldwide SBASs can be found at http://mycoordinates.org/sbass-striving-towards-seamless-satellite-navigation/.

- Mary Ann Davis (FAA AJM-321/NAVTAC)

GBAS Update

GBAS continues to move ahead nationally and internationally. Airline use of the GBAS at Newark Liberty International Airport and Houston George Bush Intercontinental Airport continues to increase. Through January 2014, United Airlines reported a total of 380 GLS approaches. With the anticipation of additional international GBAS sites in the near future and the expanding availablility of GLS equipped aircraft, other air carriers are showing great interest in adding GBAS to their operational specifications.

Development of the GBAS Approach Service Type D (GAST-D) capability that will enable GLS approach service to Category III minima continues on schedule. The FAA and industry continue with the validation of the proposed GAST-D requirements. This effort should lead to approval of a new airborne Minimum Operational Performance Standards (MOPS) in 2015, followed by formal approval of the GAST-D update to the International Civil Aviation Organization Standards and Recommended Practices (SARPS). These activities are key components in the approval of a GAST-D Ground Facility. One vendor has already requested FAA System Design Approval with approval targeted for mid-2018.

The operational use of GBAS has led to the identification of certain desired GBAS improvements. Many of the improvements were briefed or discussed at the March meeting of RTCA Special Committee 159, the group responsible for the development of GBAS MOPS.

Operations in Houston (triple runway operations) identified a need to extend the GBAS service volume significantly beyond the current service region. Extension of the GBAS service volume will improve the transition to the GLS approach at airports which have the operational requirement to line up aircraft well beyond the standard distances. The extended service volume will require

modifications to the current MOPS and will be considered for inclusion with the release of the GAST-D MOPS update.

The FAA also continued to improve its predictive outage tool, developed by its Advanced Concepts & Technology Development Engineering Development Services Division Navigation Branch, which provides prediction of GBAS availability at GBAS equipped airports.

The FAA commenced work on the approval of the next increment of Honeywell SLS-4000 capability. The Block II update improves availability by improving the flexibility to account for multipath caused by the environment around the installed GBAS and improved monitoring of potential GPS satellite signal deformation. The Block II update will also serve as the baseline for GAST-D architecture.

As mentioned in the last GBAS update, the FAA continues to co-chair with EUROCONTROL the International GBAS Working Group (IGWG) meeting. The last IGWG was held in the United States in June 2013. It was hosted by the FAA and Boeing near their B787 Dreamliner assembly plant in Washington State. The next IGWG will be hosted by EUROCONTROL at the EUROCONTROL Experimental Center in France in June 2014.

- Jed Dennis, Campbell Motley and Dieter Guenter (FAA AJM-321/NAVTAC)

Satellite Navigation Approach Procedures Update

The Satellite-based Approach Procedures table reflects the continuing growth of all types of satellite navigation approach procedures. For comparison purposes, we also include a table noting the recent inventory of Instrument Approach Procedures Based on Conventional NAVAIDs. More detailed information about satellite based instrument approach procedures, please visit our GPS/WAAS Approach Procedures page at http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/navservices/gnss/approaches/index.cfm (click here)

- Mary Ann Davis (FAA AJM-321/NAVTAC)

Satellite-based Approach Procedures (by Procedure Type)

	Procedures (Part 139 Airports)	Procedures (Non-Part 139 Airports)	Total Number of Procedures
LNAV Procedures	1,768	4,079	5,847
LNAV/VNAV Procedures	1,350	1,933	3,283
LPV Procedures *(LPV w/200' HAT)*	1,352	2,052	3,404 *(856)*
LP Procedures	75	464	539
GLS Procedures	11	0	11
GPS Stand-Alone Procedures	11	121	132

Note: Number of GPS Stand-Alone will continue to decrease as they are replaced by RNAV procedures
(Data as of May 1, 2014)

Instrument Approach Procedures (IAPs) Based on Conventional NAVAIDS

ILS	1,284
ILS (CAT II)	155
ILS (CAT III)	117
NDB	72
VOR	1,267
VOR / DME	942

(Data as of April 3, 2014)

More information is available at https://www.faa.gov/air_traffic/flight_info/aeronav/procedures/ifp_inventory_summary/ **(click here)**